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### GROWING EGYPTIAN COTTON IN THE SALT RIVER VALLEY, ARIZONA.

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#### INTRODUCTION.

Large yields of uniformly long and strong fiber of Egyptian cotton can be obtained only by proper attention to the selection and preparation of the land and by careful cultivation and irrigation of the crop. It is also very important to manage the crop so that the bulk of it will ripen early. Cotton ripened in October or November is always superior to that ripened later. Growers of Egyptian cotton should prepare the land during the previous autumn, or at latest during the winter, so as to have it ready for planting early in the spring. Egyptian cotton is a long-season crop and should be planted early in March.

The object of this paper is to describe methods of preparing the land and irrigating and cultivating the crop which have proved successful in the Salt River Valley.

#### SELECTION OF LAND.

Since it is very important that the land be prepared as early as possible, it is well for those who expect to plant cotton to have the matter in mind in handling the land with the preceding crop.

The question of what soil is best adapted to cotton is often asked. Any land that will grow good crops of alfalfa and grain will also grow good cotton. The heavier and more fertile soils as a rule will grow a smaller and more fruitful plant with shorter nodes, and hence more fruiting branches. While some raw desert land will make good cotton, it has been demonstrated that land previously in alfalfa will produce better cotton, and the crop can be produced more economically. New land does not hold the water so well and as a rule requires more frequent irrigation. It is usually uneven, with spots of lighter soil here and there which have to be irrigated separately in order to keep the growth uniform. While in some instances good yields of excellent fiber have been obtained on raw land, the best results are to be had on old land, especially if it has previously been in alfalfa.

A great deal of the land in the Salt River Valley of Arizona is infested with Bermuda and Johnson grasses. This infestation is worse on land that was under cultivation prior to the completion of the Roosevelt Dam. The growing of a cultivated crop is the surest means of ridding the land of these troublesome weeds. There are, conservatively speaking, fully 10,000 acres on the south side of the Salt River alone that would be greatly benefited by cropping with cotton. This is as good land for cotton as any in the valley. Most of it is level, and it has been made rich by crops of alfalfa.

#### SLOPE OF THE LAND.

Land that is nearly level will require less water for the crop, can be irrigated more evenly, and will produce more uniform cotton than land with a heavy slope. If there is much grade to the land it will be found that the fields dry out in spots during August and September, and in order to avoid injury to the cotton it will be necessary to irrigate these spots separately, thus causing much extra work. The best grade to be given will depend somewhat upon the character of the soil, a steeper grade being possible in light soils into which the water sinks readily than in heavy soils which will not become thoroughly wet unless the water stands for some time. Where alfalfa land is plowed up in order to plant cotton it is often advisable to irrigate the cotton in a different direction from that used in irrigating the alfalfa, in order to secure a lighter grade.

#### EARLY PREPARATION OF THE LAND.

The first stage in the preparation of the land depends upon its condition, whether weedy or clean, and upon the nature of the preceding crop.

In preparing land which is overrun with Johnson grass for cotton, the best plan is to plow about 2 inches deep during August, allowing the soil to dry out thoroughly; then to disk and harrow thoroughly, dragging as many of the roots to the surface as possible. A spring-tooth harrow may be used to advantage in this work. During November or December the land should again be given a shallow plowing and pulverized by disking and harrowing. At this time it may be well to go over the land both ways with an orchard cultivator or some similar tool having long teeth. This will bring a great many of the roots to the surface, and if in sufficient quantity they should be raked up and burned or hauled off the field. The land may then be left fallow until the latter part of February.

Bermuda grass alone is not so hard to eradicate as Johnson grass or a mixture of Bermuda and Johnson grasses. It is possible by shallow plowing during November or December, followed by thorough disking and harrowing, to put Bermuda-grass land in shape for cotton. If the land is kept thoroughly disked and harrowed during the winter, the freezing will greatly aid in killing the roots. Two or three weeks before planting, the land should be plowed from 4 to 6 inches deep and thoroughly pulverized. If regular cultivation be kept up during the early part of the growing season, or until the cotton plants become large enough to shade the ground, the Bermuda grass will not have a chance to establish itself sufficiently to become a nuisance.

It may cost the grower from \$6 to \$10 an acre to put Bermuda and Johnson grass land in proper condition for cotton. The weeds can then be kept down by intensive cultivation, although it may be found necessary to chop out the grass in the rows at the time the cotton is being thinned, and in bad cases once or twice later in the season.

By this method it is possible for the growers to eradicate both of these grasses within two years and to grow a remunerative crop on the land while this is being done.

In preparing to plant cotton on alfalfa land which is not overrun with Bermuda or Johnson grass, the same general plan can be followed. However, it will not be necessary to do as much disking and harrowing or cross plowing as in the case on land infested with Bermuda or Johnson grass. If alfalfa land is plowed 2 inches deep early in the autumn and turned up to the sun until thoroughly dry and then later in the season plowed 4 to 6 inches deep, there will be very little trouble from the growth of alfalfa during the following season. While alfalfa land may be prepared at any time prior to the planting season, the best results will be obtained if the land is plowed first in October or November, followed by a second plowing in January.

In preparing cotton land for planting again to cotton, a stalk cutter should be used to chop the stalks into small pieces. Then the land should be plowed, disked, and harrowed until in perfect tilth, when it may be left until planting time. In the absence of a stalk cutter the plants can be dragged down with a heavy drag after a hard freeze. A great many of the stalks will be pulled out, and those remaining in the ground can be loosened with a mattock. This treatment is inexpensive, costing only about \$1 or \$1.25 per acre. After all the plants are pulled out of the ground, the field should be raked crosswise with a hayrake and the stalks put up in windrows and burned.

#### PREPARATION OF THE SEED BED.

There will be no occasion to regret the labor expended during the winter in preparing the seed bed, since if this is done thoroughly a great deal less work will be required during the summer to grow the crop, and the yield will be correspondingly larger.<sup>1</sup>

It depends upon the kind of soil and the condition it is in whether a double plowing is necessary to put the land in good tilth or whether this can be done with a single plowing and double disking and double harrowing. Land previously in cotton or grain, if irrigated before plowing, can be put in perfect condition by one plowing. Land previously in alfalfa should be plowed twice. During the latter part of February borders should be thrown up about 2 rods apart. Just before planting time, which is between March 10 and April 1, the land should be flooded and then disked and harrowed until in perfect tilth.

<sup>1</sup> As an example of how not to go about this work, the case may be cited of a farmer who last year plowed and leveled his land very poorly and, instead of disking several times after the irrigation just before planting the seed, made small furrows and planted the seed with the idea of pulverizing the land when cultivating. This piece of cotton had to be hoed twice and cultivated several times more than a near-by field which was double-disked and harrowed until it was in perfect condition before the seed was planted.

At this time, if the soil is very heavy it may be advisable in rare instances to throw up beds, for the reason that land of this character may have to be irrigated in order to germinate the seed. The beds should be made  $3\frac{1}{2}$  feet wide and 8 inches high, but should be dragged down to not more than half of this height before planting. A drag can easily be constructed of 2 by 6 inch scantling that will take two (or possibly three) beds at a time. It should be weighted down until it drags off enough of the surface clod to get down to the moist soil. Bedding is usually unnecessary,<sup>1</sup> since, if pulverized sufficiently after a thorough irrigation and before planting, most of the soil of the Salt River Valley will hold moisture enough to bring up the seed without further watering.

### PLANTING.

Planting should be done between March 10 and April 1, or as soon as possible after the danger of frost is over. Either a 1-horse or a 2-horse planter may be used, though the latter will be more satisfactory.

On land which has been made very rich by previous crops of alfalfa and Bermuda grass, cotton should be planted in rows 4 feet apart. On new land, desert land, and grain land that has never been in alfalfa, the rows should be 3 feet apart.

Under normal conditions, seed should not be planted less than 1 inch or more than 2 inches deep. If the soil is in perfect condition, 1 to  $1\frac{1}{4}$  inches is a sufficient depth to plant, but one should always bear in mind that the seed must be planted deep enough to insure prompt germination and bring the young plants above the ground. It is very important that only as much land should be irrigated at one time as can be prepared and planted before it becomes too dry to germinate the seed. Failure to follow this practice often results in a poor stand.

To insure a good stand, from 40 to 50 pounds of seed to the acre should be planted. This quantity will give a thick drill of seed, which, germinating together, will break through any crust that may form. A thin drill of seed on land which tends to crust is very apt to result in a poor stand of cotton.

It is never advisable to flood the land after planting in order to germinate the seed, since the young plants are unable to push through the crust formed by flooding and a poor stand results. In the case of very heavy land which has been bedded, an irrigation in furrows may be given in order to germinate the seed.

### EARLY CULTIVATION.

As soon as the plants are visible in the rows, cultivation should begin. It is very important to cultivate as soon as possible, in order to break any crust that may have formed, to check evaporation, and to kill the weeds. The benefits from frequent shallow cultivation at regular intervals during the early growing season are that the root system will develop better, the soil will be aerated, weeds will be kept down, and less water will be required.

<sup>1</sup> None of the soils thus far planted to cotton in the Salt River Valley are of such a character as to necessitate bedding. Experiments conducted at Sacaton last year proved that bedded land required four more irrigations than land which was not bedded.

### EARLY IRRIGATION.

If the land is level and contains the proper amount of moisture when the seed is planted, and if intensive cultivation is practiced, the crop will not require an irrigation for six weeks or two months after planting, except on new land, which may require irrigation sooner. At the end of this time, the cotton should be given a light furrow irrigation, followed by cultivation as soon as the ground is dry enough to work. In some instances one cultivation after an irrigation will be sufficient to mulch the surface properly. If one cultivation does not put the field in good condition, it should be gone over a second time as soon as possible. In any event the crop should be cultivated again in ten days or two weeks. Under ordinary conditions it will not be necessary to irrigate again for three or four weeks, when the field should be given another light irrigation, followed by thorough cultivation. These two irrigations should be enough to carry the crop until about July 1. It is understood that cultivation should always follow any rains that may come.

It may be necessary to irrigate more frequently on new land, owing to the fact that such land will not retain moisture so well as land that has been in crop, particularly alfalfa. In all probability new land will have to be irrigated at least three or four times between the date of planting and July 1. Certain types of old land may also require an extra irrigation during this period. Wilting of some of the plants in the middle of the day during the early stages of development is not conclusive evidence that a general irrigation is needed.

The reason for irrigating sparingly during the first part of the season is to prevent the too rapid growth of the plants. If given frequent heavy irrigations, the plants will grow woody and they will be apt to maintain this tendency throughout the season at the expense of fruitfulness. The foundation for maximum production will be laid if only sufficient water is given the plants during the early stage of development to keep them in a healthy growing condition.

### THINNING.

Cotton should generally be thinned after the second irrigation, when the plants are between 8 and 12 inches high. On land which has been enriched by previous crops of alfalfa and where the rows are 4 feet apart, the crop should be thinned so as to have the plants from 8 to 16 inches apart in the row. On new land or land that has previously been in cotton, where the rows are 3 feet apart, the plants should be thinned to from 4 to 6 inches apart, depending upon the richness of the soil.

Usually the grower can contract for the thinning or chopping at a cost of \$1 per acre, which will allow the workman fair wages. The thinning may be done in one or two operations. While the productiveness of the individual plants does not seem to be increased by thinning twice, this is likely to result in a more uniform stand and hence in a larger total yield.

If the cotton is to be thinned twice, the plants may be thinned after the first irrigation and cultivation to a distance of 2 or 3 inches apart in the row. This distance will give the remaining plants room to grow and will insure plants enough to replace those which may be

killed during the later cultivations. By thus leaving the plants somewhat crowded, the tendency to develop large limbs or vegetative branches will be checked and the development of fruiting branches will be favored.<sup>1</sup> The final thinning may in this case be delayed until the plants are larger and stronger than when the thinning is done in one operation. Thinning should be conducted so as to obtain a uniform stand of plants properly spaced in the row. For example, if the nature of the soil requires that the plants be thinned to a distance of 6 inches apart, the largest possible yield will be obtained if there is a plant in every 6 inches of the row in all parts of the field.

#### LATE CULTIVATION.

Cultivation should continue at intervals of from 10 to 15 days as long as a horse can get between the rows of cotton without breaking the plants. It will be found more economical to use a riding cultivator until the plants are too high.

When the plants have 8 to 10 leaves, it is desirable to begin to draw the earth toward the plants. This may be continued very gradually at each cultivation until the plants are on a ridge 3 to 4 inches high and 12 to 14 inches wide. The advantage of having the cotton plants ridged in this manner is that in the later irrigations a more even distribution of the water can be secured. This practice also helps to conserve the moisture in the soil immediately around the plants and to cover up any weeds and grass that may start between the cotton plants.

After the cotton plants have become so large that a 2-horse cultivator can no longer be used, the crop may be cultivated once or twice with a single-row 7-shovel cultivator or with a spike-tooth cultivator. These very late cultivations will of necessity be in the middle of the rows and thus will not disturb the small ridge that has been thrown up around the cotton plants. Having the cotton plants on a small ridge will also greatly facilitate handling the late irrigations after the plants have become too large to cultivate.

#### LATE IRRIGATION.

After July 1 on most soils the crop will probably require an irrigation every 10 or 15 days. At this time the cotton plants will be flowering and should be given enough water to prevent any serious wilting during the middle of the day. Some wilting early in the season does little or no harm, but after the flowering begins the plants must not be allowed to wilt. When the flowers can be seen above the crowns of the plants and a decided yellow color is noted in looking out over the field, it is evident that irrigation has been postponed too long. This rule holds good until after the first of October.

To obtain a maximum yield it is imperative that strict attention be paid to late irrigation. Late irrigation on soil that will take water evenly should not exceed a 6-hour run. Some fields are so spotted and take water so unevenly that it may be necessary to allow water to run longer. These are exceptions, however, and indicate a very poor soil or an excessive grade.

<sup>1</sup> Cook, O. F. A New System of Cotton Culture. U. S. Department of Agriculture, Bureau of Plant Industry, Circular 115, pp. 15-22, March 1, 1913.

— The Abortion of Fruiting Branches in Cotton. U. S. Department of Agriculture, Bureau of Plant Industry, Circular 118, pp. 11-16, March 22, 1913.

After an irrigation, the water should always be drained off and not allowed to stand in the lower part of the field, as this is not only bad for the cotton but injures the land. From observations made in 1913 it is believed that some farmers in the valley reduced their yields materially by giving excessive irrigation late in the season and allowing the water to stand in a lake at the lower part of the field.<sup>1</sup>

After the first picking, at least one or two irrigations should be given.

None of the soils of the Salt River Valley are perfectly uniform. During the latter part of the season practically every field will contain spots, varying in extent, where the plants need water before a general irrigation is necessary. By throwing a ridge across the field and turning a small head of water down between the rows, the spot that is drying out may be irrigated without wetting the rest of the field. This practice, of course, entails a little extra expense in irrigating, but the uniformity and increased yield thereby obtained will more than balance the additional cost. Following this practice in one case increased the yield by a third of a bale of lint per acre, as compared with that obtained on similar soil in a field not handled in this manner.

#### PICKING.

Picking should begin between September 15 and October 1. It is necessary to pick the crop at least three times. Egyptian cotton must be picked clean—that is, free from trash—in order to command the very best price, for no dependable cleaning device has been found which can be attached to the roller gin. The farmer who violates this rule, hoping that the grader will overlook dirty cotton, which has been picked with a lot of broken leaves and squares mixed through it, is certain to be disappointed in the price obtained for his product.

The Egyptian cotton grown in the Salt River Valley will doubtless be graded more closely every succeeding year. The associations and exchanges which are helping the growers in selling their crops can not afford to market a poor and dirty grade of cotton. In order to find a ready market for cotton having so long a staple, it will be necessary that the community establish a reputation for the cleanliness of its product. To this end, the associations must use much discrimination in grading, throwing into the inferior grades all dirty cotton as well as that which has been damaged by frost or by poor irrigation.

The different pickings of Egyptian cotton should be kept separate in ginning and baling, as there is often a marked difference in each picking, which will be detected when the grading is carefully done. Frosted cotton should always be picked separately and ginned and baled apart from earlier pickings. If a hard frost kills the plants, it is advisable to pick as soon afterwards as possible all cotton that is open, thus avoiding mixing the cotton from bolls which opened before with that from bolls which opened after the frost. This will not be necessary if the field has been gone over just before the frost and very little cotton is open on the plants.

Effort should be made to time the pickings so that the second picking will not be made until late in the season. Where the crop is very heavy and the first picking is early, it may be necessary to make four

<sup>1</sup> When water is regularly allowed to stand at the bottom of the field for several hours after irrigation, the fiber produced is apt to be weak.



pickings, but it is believed that three, properly distributed, will usually be sufficient. Growers often begin picking much earlier than is necessary. A few open bolls are mistaken for a good picking. It does not pay to make the first picking until from 600 to 1,000 pounds of seed cotton per acre can be obtained.

Until recently it was believed that Americans could not pick Egyptian cotton at 2 cents a pound and make living wages comparable with what could be made in picking cotton in the Southern States. This matter has been closely followed in southern Arizona during the past two years, and it is now fairly certain that the average workman from the Southern States can make more money picking Egyptian cotton in Arizona than in picking Upland cotton in the South. The case was thus stated by one young man:

I thought at first that I could not pick this small-boll cotton and was badly discouraged, but found after working a week that I could pick 200 to 225 pounds a day and do it easily. You don't have to carry a big, heavy sack around all the forenoon and break your back picking Egyptian cotton, and you have only to pick half as much of it as short cotton to make the same wages or more.

Two cents per pound is a fair price for picking Egyptian cotton, and industrious workers can make as much as \$4 per day, although the average picker will hardly exceed \$2.25 per day. The record so far for Arizona is an average of 270 pounds per day for six days, with a maximum of 300 pounds, or \$6, for one day.

The most important supply of labor for cotton picking in Arizona is afforded by the Papago and Pima Indians. There are, conservatively speaking, 5,000 to 7,000 people in these tribes who promise by virtue of their industry, patience, and honesty to play a most important part in establishing the cotton industry. The Indians are the most satisfactory laborers that can be had in Arizona for this work and have done well wherever they have been employed. They are satisfied with fair returns for their labor and have learned to like the work, although until recently they were totally unfamiliar with it. It is of the utmost importance that this labor supply be developed thoroughly and that the Indians be treated fairly.

#### GINNING AND BALING.

The ginning and baling of Egyptian cotton should receive much attention, since spinners of this type of cotton are accustomed to a product which is much more carefully handled than American Upland cotton. Roller gins must be used, and a first-class mechanic is required to operate the ginning plant. There should be no leaves, seeds, or other trash in the cotton when it goes to the press. The cleanness, or "grade," is a very important factor in the price paid for a fancy cotton of this character.

The bales should present a neat appearance, comparable to those which are exported from Egypt. They should be thoroughly covered with heavy burlap, and the ends should be sewed. For each bale a large and representative sample should be taken during the ginning, so that it will not be necessary to cut open the bale in negotiating for its sale.

